ENGINEERING-SCIENCE, INC.

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December 6, 1993
SP307 120693 01

Mr Randy T Ogg
Environmental Restoration Program Manager
EG&G Rocky Flats
P O Box 464, Building 080
Golden, Colorado 80402-0464

Dear Randy

On Wednesday December 1, 1993, you verbally requested ES to perform the following tasks to help EG&G/DOE select a closure/remedial alternative for the OU4 Solar Evaporation Ponds

1) Determine the volume of contaminated soil on the north hillside that exceeds the Land Disposal Restriction (LDR) concentrations

2) Assess whether compliance with the hazardous waste landfill siting criteria can be achieved

3) Provide an anticipated cost to achieve compliance with the hazardous waste landfill siting criteria

This information was requested by Monday December 6, 1993

Enclosed are responses to these questions based on the best available information and engineering judgement In summary 1) the results of the contaminated soil assessment indicate that there is widespread contamination in the surface soils on the north hillside but a small areal extent of vadose zone hillside contamination, 2) ES considers that successful determination of compliance with the hazardous waste landfill siting requirements would be highly risky, and is largely dependent upon the design of engineered measures to ensure the long-term overall protection of human health and the environment, 3) based on this analysis the anticipated costs associated with the installation of a 1000 year engineered cover are less than the anticipated costs of liner disposal at the Envirocare facility ES is concerned that other impacts associated with the implementation of the 1000 year cover which could not be assessed at this time, such as interferences with active facilities and systems outside the OU4 boundary could cause the cost of the 1000 year engineered cover alternative to exceed the cost of the alternative for liner disposal

R9 11 24 WPF

PARSONS

If you have any questions, please feel free to contact me at 831-8100, extension 207

Sincerely,

Philip A Nixon
Project Manager· IM/IRA Solar Evaporation Ponds

cc M Austin
K Ruger
S Paris
B. Wallace (Admin. Record) (2)
R Wilkinson
T Kuykendall
R Stegen
B Cropper
H Heidkamp
S Stenseng
A Conklin
L Benson
K Cutter
C Montes
D Myers
R Henry
P Breen

1. Volume of Contaminated Media Exceeding the LDR Concentrations

As discussed in the Team Meeting on November 30, 1993, nickel and cadmium are the hazardous constituents that have been detected in north hillside soils at concentrations that exceed the Preliminary Remediation Goals (PRGs) and the LDR concentrations required for soil disposal in a hazardous waste landfill ES calculated the allowable concentration in the hillside soil for LDR constituents by multiplying the required LDR concentration by 20 The factor of 20 was used because the hillside soil concentrations were analyzed as total constituent concentrations where as the LDR concentrations are based upon TCLP analysis In general TCLP analysis results provide lower concentrations than total constituent analysis results because not all of a contaminant is leached from the sample during the TCLP procedure The dilution factor (20) is specified in 40 CFR 261 within the discussion describing the TCLP procedure

It should be noted that the modified PRG for cadmium in surface soil is 2 47 mg/kg, and the LDR concentration is conservatively calculated at 1 32 mg/kg Since it has been determined at previous Team Meetings with the Colorado Department of Health (CDH) and the Environmental Protection Agency (EPA) that media is considered contaminated if it exceeds the modified PRGs, ES calculated the volume of soil on the north hillside that has concentrations exceeding the PRG The contaminated media calculations was performed only for the north hillside soils and does not include any estimated volume of contaminated materials under the Solar Evaporation Ponds It was assumed that contaminated media within the berms or under the Solar Evaporation Ponds would be under an engineered cover and would not require excavation

ES examined the recent RFI/RI data plots to determine the areal extent of surface and borehole soil contamination A conservative PRG concentration contour was hand drawn on the plot to encompass the area where soils exceeded the PRG concentration The surface area within the PRG contoured area was computer calculated from a topographical computer model of the site Surface soil depth is 6 inches because it was assumed that it would be difficult to excavate only the top 3 inches The depth of the vadose zone soils was assumed to be 6 feet since the RFI/RI sampling program composited soils within the first 6 feet and did not sample at discrete intervals The volume was calculated by multiplying the area by the depth However, the volume of contaminated vadose zone soil was calculated by multiplying the areal extent by 5 5 feet because the first 6 inches was included in the surface soil calculation

The nickel concentration exceeded the PRG and LDR concentration at only one surface sample location on the north hillside A volume of nickel contaminated soil was not calculated because the location was encompassed by the area where soil is contaminated with cadmium

The calculated areal extent of cadmium contaminated surface soil on the north hillside is 163,627 square feet, rounded to 164,000 square feet for this estimate The volume of

cadmium contaminated surface soil is therefore 82,000 cubic feet or 3,100 cubic yards The calculated areal extent of cadmium contaminated vadose zone soil is 13,442 square feet, rounded to 14,000 square feet The volume is therefore 77,000 cubic feet or 2,900 cubic yards The total estimated volume of north hillside soil that is contaminated by cadmium at concentrations exceeding the PRG is 159,000 cubic feet or 6,000 cubic yards It should be noted that additional characterization at discrete depth intervals would determine the depth of vadose zone soils requiring excavation

There are no LDR soil activity-concentrations promulgated for the radionuclide contaminants of concern ES plotted the radionuclides and compared the north hillside activity-concentrations against the modified PRGs to determine if the hillside concentrations exceed the PRGs Plutonium-239/240, Americium-241, and Uranium 235 had surface soil activity-concentrations that exceeded the modified PRGs on the north hillside However there were no locations in the vadose zone where the activity-concentrations exceeded the modified PRGs Pu-239/240 and Am-241 contamination in the surface soils was widespread on the hillside south of the security fence Most of the locations with Pu-239/240 contamination were also contaminated with Am-241 U-235 contaminated surface soils were located to a much smaller area encompassed by the area of Pu-239/240 and AM-241 contamination

The combined calculated areal extent of PU-239/240, AM-241 and U-235 contaminated surface soil is 215,754 square feet, rounded to 216,000 square feet for this estimate The volume is therefore 108,000 cubic feet or 4,000 cubic yards

The area of cadmium contaminated surface soil is encompassed by the area of radiologically contaminated surface soil Therefore, the total volume of contaminated soil is predicted to be the sum of the radiologically contaminated surface soil and the cadmium contaminated vadose zone soil This estimated volume is 185,000 cubic feet or 6,900 cubic yards

2. Assessment of Whether the Hazardous Waste Landfill Siting Criteria can be Achieved

As discussed in the Team meeting on November 30, 1993, it may be possible to demonstrate compliance with the substantive requirements of the hazardous waste landfill siting requirements to the satisfaction of CDH The success of the demonstration would largely be dependent upon the engineering controls that would need to be provided to ensure that overall protection of human health and the environment for a 1000 year period

The key to a obtaining a favorable determination from CDH lies in proving that the remedy is protective to human health and the environment The requirements for siting hazardous waste disposal sites (6 CCR 1007-2) Section 2 4 1 states that,"Sites intended for use as landfills, surface impoundments and land treatment facilities shall be located and designed

in a manner that the design performance will assure long-term protection of human health and the environment" Section 2 5 3 states, "The geological and hydrological conditions of a site in which hazardous wastes are to be disposed shall be such that reasonable assurance is provided that such wastes are isolated within the designated disposal area of the site and away from natural environmental pathways that could expose the public for 1000 years, or some demonstrated shorter period in which the wastes are transformed to an innocuous condition "

ES is confident that engineering features can be designed to provide compliance with the requirement for the protection of human health and the environment. The 1000 year period would likely be required since some of the site contaminants are radionuclides with half-lives that would not reduce them to innocuous isotopes in a shorter period The engineered features would include a cover, surface water runoff controls, and post-closure monitoring systems A subsurface low permeability barrier may also be required to prevent contaminant migration to groundwater However, there is concern that implementation of the engineered features to meet the 1000 year contaminant isolation/protection requirement may be very difficult at the OU4 site (see item #3)

The most significant challenge will involve demonstrating that the site geological and hydrological conditions are adequate for the siting of a hazardous waste landfill The goal of the hazardous waste landfill siting requirements is to select a location that is expected to be suitable for containing the wastes and isolating them from the pathways of environmental exposure for 1000 years The fact that DOE has already installed a system to collect contaminated vadose zone liquids and has committed to remediating surface soils and potential releases to groundwater is proof that the waste containment has likely failed over the 30 years of operation In 1951, before any buildings or structures were constructed, the area now occupied by the Solar Evaporation Ponds was evaluated to determine the suitability of the site for the surface impoundments The Report prepared by M R Mudge and R F Brown of the United States Geological Service (1952) entitled "Rocky Flats Plant- Pond Site, Geology and Ground Water of the Rocky Flats Area" specified that pediment gravels overlie impervious clays, but that the clays are fractured and capable of transmitting water downward This historical information indicates that the site might not be suitable for the siting of a hazardous waste landfill If the site is not naturally well suited for the isolation of hazardous wastes, then any implemented engineered improvements would likely be required to have a design life of 1000 years

There is a high level of risk associated with a successful demonstration of compliance with the siting criteria The high level of risk is attributed mostly to the fact that the demonstration will have a significant amount of qualitative assessment and that the CDH may not be able to provide a favorable determination if the public provides negative comments Qualitative assessments typically provide an easier target for comment and criticism than quantitative assessments Comments from the regulatory agencies or the public could adversely impact the project schedule as additional investigations or modeling may be required to substantiate points made in the assessment In addition,

it is possible that the selected closure/remediation alternative could be reversed after substantial design effort if comments could not be addressed to the satisfaction of the regulatory agencies or the public

ES supports the position that the siting requirements for a hazardous waste landfill do not apply to the OU4 Solar Evaporation Ponds This position is based upon the fact that there are no requirements, within the Colorado Hazardous Waste Regulations or the regulations pertaining to solid and hazardous wastes (Part 2), to perform an assessment of existing surface impoundments to determine if the siting requirements are satisfied Nor are there any requirements which drive the closure of existing surface impoundments that are not adequate Additionally, since the requirements state that "closed or inactive on-site surface impoundments are not considered to be landfills " The Solar Evaporation Ponds should be considered inactive since they are no longer receiving wastes from the Rocky Flats Production Facilities Therefore, the Solar Evaportation Ponds need not satisfy 6CCR 1007-2

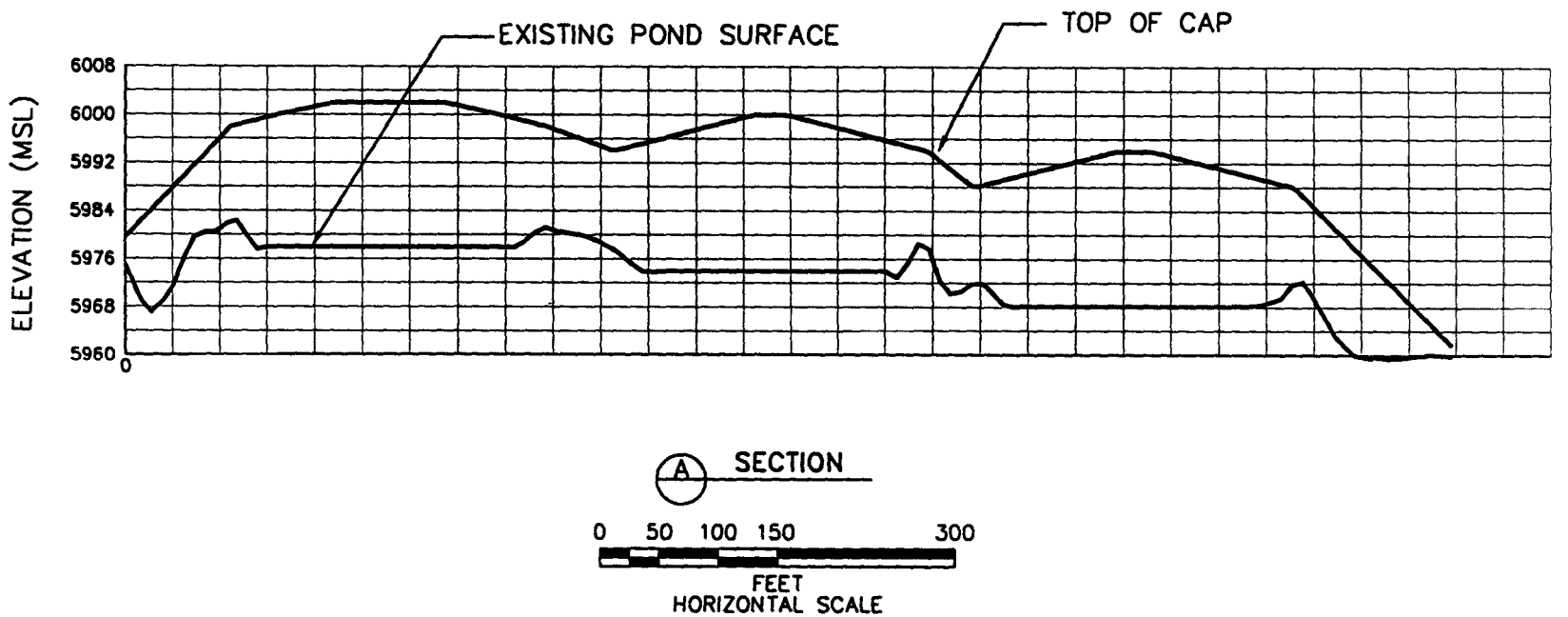
3) Anticipated Costs to Achieve Compliance with the Hazardous Waste Landfill Siting Criteria

ES addressed this question by providing a magnitude of cost estimate for an engineered cover that might be used to achieve the 1000 year design life requirement, and estimating the cost of preparing a document that demonstrates compliance with the siting requirements

The DOE Hanford Facility in Washington State is designing an engineered cover to meet a 1000 year design life requirement ES used their design as a model for an engineered cover over the OU4 Solar Evaporation Ponds The engineered cover would be approximately 16 feet thick ES modeled the cross section and areal extent of the cover and calculated the quantity of materials that would be required Figure 1 provides the computer modeled cross sectional portrayal of the engineered cover at a 5:1 side slope. Figure 2 presents the areal extent of the modeled cover and specifies that the anticipated surface area would be 948,800 square feet (approximately 22 acres) It is important to note that the toe of the engineered cover would extend past the road which borders the Rocky Flats Protected Area and may impact the Protected Area Security system In addition, It is likely that the southern toe of the cap would interfere with the cooling towers south of C-Pond and the waste storage tanks south of A-Pond Building 910 may also be impacted by the cover's toe The cost of these additional impacts could not be assessed in the time allotted for this task ES is therefore concerned with respect to whether this engineered cover is implementable at the OU4 site In addition, the stability of the north hillside is in question This alternative would require detailed geotechnical analysis to determine whether the hillside could support the load from the engineered cover which would be significantly higher than the load applied during Solar Evaporation Pond operation

ES incorporated the material and installation cost for the 1000 year engineered cover into the magnitude of cost estimating spreadsheets that were used to evaluate alternatives during the detailed analysis of alternatives The estimated magnitude of cost for leaving the liners in the Solar Evaporation Ponds and constructing a Hanford-type engineered cover is approximately 26 million dollars (Figure 3) ES and EG&G will travel to Hanford on December 7-8, 1993 to further investigate the Hanford cover Detailed design and cost information will be discussed during the meetings which may provide for more accurate cost estimating For comparison, the estimated magnitude of cost for removing and shipping the liners with a less extensive engineered cover would be approximately 68 million dollars (Figure 4)

ES estimates that approximately 1000 additional hours would be required to prepare the document demonstrating compliance with the hazardous waste landfill siting requirements These hours are based on the assumption that 2 engineers would work full time for 2 months to review existing documents and prepare the demonstration It was assumed that 1 engineer would spend 1 month addressing comments Clerical hours were also included for typing and producing the report The anticipated cost of this task is approximately $70,000 00



NOTE 5 1 VERTICAL TO HORIZONTAL SCALE

FIGURE 1 **SOLAR EVAOPORATION PONDS - OU4**
ROCKY FLATS
16' THICK CAP W/ 5:1 SIDE SLOPES

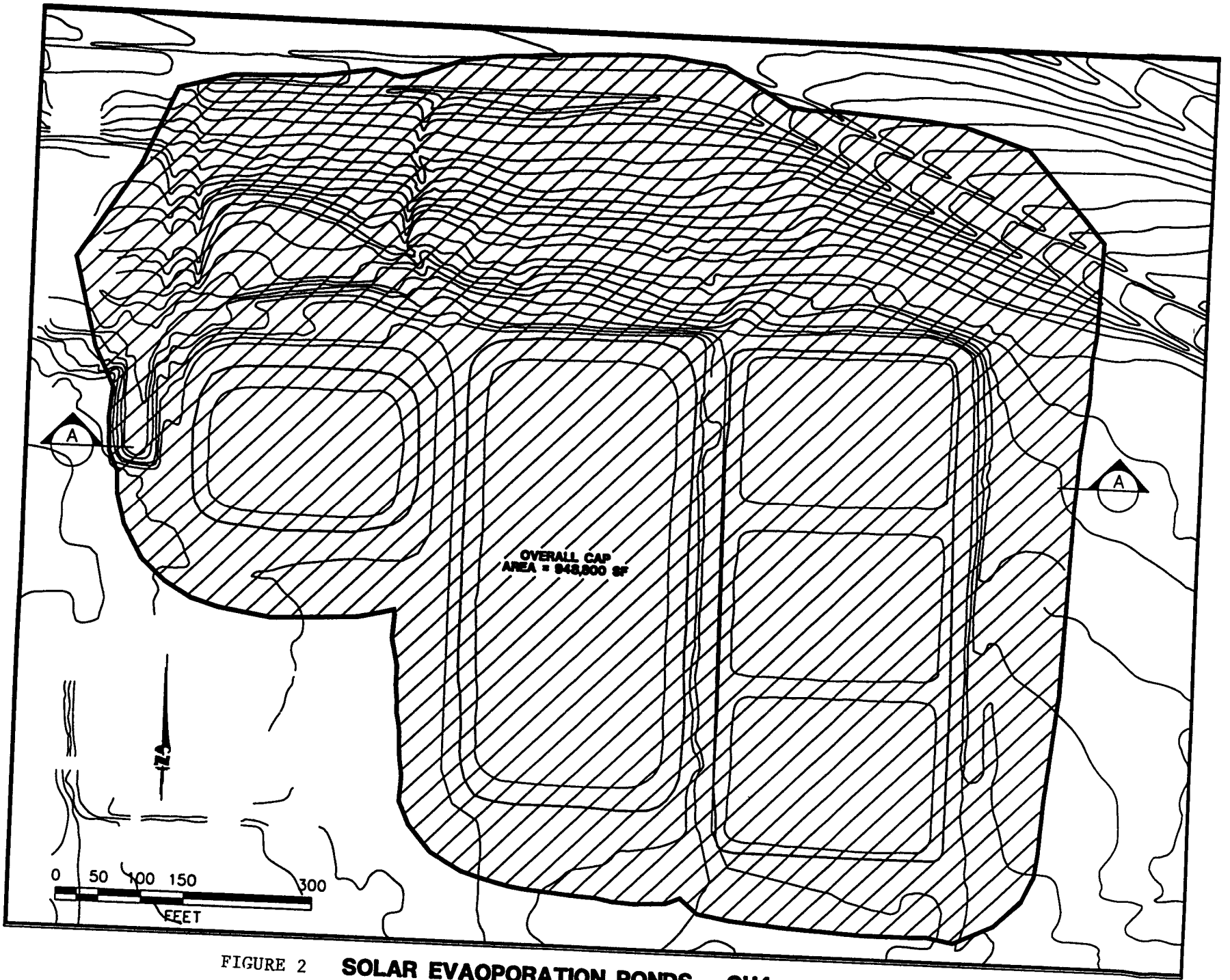


FIGURE 2 **SOLAR EVAOPORATION PONDS - OU4**
ROCKY FLATS
16' THICK CAP W/ 5:1 SIDE SLOPES

Figure 3

OU4 PHASE I IM/IRA – ALTERNATIVES SELECTION

ROUGH ORDER OF MAGNITUDE (ROM) ESTIMATE

ALTERNATIVE II – 1000 year cover

DATE. 3 December 1993

ITEM	TASK	RESPONSIBILITY	EQUIPMENT	UNIT COST ($/UNIT)	QUANTITY	TOTAL COST
1	NON-INTRUSIVE SURVEY	EG&G	Monitoring	651 /Man-Day	5 Man-Days	4,000
2	PURCHASE ASSAY EQUIPMENT	EG&G	PAN assay	807,000	0 LS	0
3	INSTALL ASSAY EQUIPMENT	Contractor		75 /Hour	0 Manhours	0
4	PURCHASE WASTE BOXES	Contractor		260 Each	0 Boxes	0
5	OFFLOAD WASTE BOXES	Contractor	Fork Truck	55 /Hour	0 Hour	0
6	MONITOR REMEDIATION	Contractor	Monitoring	240 /Man-Day	0 Man-Days	0
7	EXCAVATE LINERS	Contractor	Pay Loader	4 /CY	0 CY	0
8	CRUSH LINERS/LOAD WASTE BOXES	Contractor	Crusher	400 /Hour	0 Hours	0
9	EXCAVATE SOIL/LOAD WASTE BOXES	Contractor	Pay Loader	2.5 /CY	0 CY	0
10	TREAT SOIL/LOAD WASTE BOXES	Contractor		16,255,000	0 LS	0
11	INSTALL WASTE BOX LIDS	Contractor		40 /Hour	0 Manhours	0
12	MOVE WASTE BOXES TO ASSAY	Contractor	Fork Truck, Flatbed	65 /Hour	0 Manhours	0
13	ASSAY WASTE BOXES	EG&G		84 /Manhour	0 Manhours	0
14	MOVE WASTE BOXES TO RAILCARS	Contractor	Fork Truck, Flatbed	65 /Hour	0 Manhours	0
15	TRANSPORT TO DISPOSAL FACILITY	Southern Pacific	Railcars	2,210 /Railcar	0 Railcars	0
16	DISPOSAL	EnviroCare		32 /CF	0 CF	0
17	BACKFILL COVER SITE	Contractor		1,800,000	0 LS	0
18	ENGINEERED COVER SITE	Contractor		12,169,000	1 LS	12,169,000
19	FINAL SITE SURVEY	Contractor	Monitoring	651 /Man-Day	21 Man-Days	14,000
20	FINAL SITE PREPARATION	Contractor/EG&G	Drilling rig/Equip Decon	591,000	1 LS	591,000
21	SECURITY ESCORTS/TRAINING	EG&G		40 /Manhours	19,200 /Manhours	768,000
22	SUBTOTAL CONSTRUCTION					13,546,000

OU4 PHASE I IM/IRA – ALTERNATIVES SELECTION

ROUGH ORDER OF MAGNITUDE (ROM) ESTIMATE

ALTERNATIVE II – 1000 year cover

DATE. 3 December 1993

ITEM	TASK	RESPONSIBILITY	EQUIPMENT	UNIT COST ($/UNIT)	QUANTITY	TOTAL COST
23	ENGINEERING	A/E		10 Percent		1,355,000
24	CONTRACTOR G&A			10 7 Percent		1,335,000
25	PROCUREMENT	EG&G		3 Percent		374,000
26	PROJECT & CONSTRUCTION MGMT (P&CM)	EG&G/CM		16 Percent		2,384,000
27	SUBTOTAL					18,994,000
28	ESCALATION			3 6 Percent		684,000
29	SUBTOTAL					19,678,000
30	CONTINGENCY			30 Percent		5,903,400
31	TOTAL ESTIMATED COST					$25,581,400

Figure 4

OU4 PHASE I IM/IRA – ALTERNATIVES SELECTION

ROUGH ORDER OF MAGNITUDE (ROM) ESTIMATE

ALTERNATIVE IV – Liner removal – No soil treatment – Engineered cover DATE 3 December 1993

ITEM	TASK	RESPONSIBILITY	EQUIPMENT	UNIT COST ($/UNIT)	QUANTITY	TOTAL COST
1	NON-INTRUSIVE SURVEY	EG&G	Monitoring	651 /Man-Day	5 Man-Days	4,000
2	PURCHASE ASSAY EQUIPMENT	EG&G	PAN assay	807,000	1 LS	807,000
3	INSTALL ASSAY EQUIPMENT	Contractor		75 /Hour	800 Manhours	60,000
4	PURCHASE WASTE BOXES	Contractor		260 Each	12,800 Boxes	3,328,000
5	OFFLOAD WASTE BOXES	Contractor	Fork Truck	55 /Hour	1,067 Hour	59,000
6	MONITOR REMEDIATION	Contractor	Monitoring	240 /Man-Day	400 Man-Days	96,000
7	EXCAVATE LINERS	Contractor	Pay Loader	4 /CY	11,740 CY	47,000
8	CRUSH LINERS/LOAD WASTE BOXES	Contractor	Crusher	400 /Hour	1,200 Hours	480,000
9	EXCAVATE SOIL/LOAD WASTE BOXES	Contractor	Pay Loader	2.5 /CY	0 CY	0
10	TREAT SOIL/LOAD WASTE BOXES	Contractor		16,255,000	0 LS	0
11	INSTALL WASTE BOX LIDS	Contractor		40 /Hour	2,133 Manhours	86,000
12	MOVE WASTE BOXES TO ASSAY	Contractor	Fork Truck, Flatbed	65 /Hour	1,280 Manhours	84,000
13	ASSAY WASTE BOXES	EG&G		84 /Manhour	5,760 Manhours	484,000
14	MOVE WASTE BOXES TO RAILCARS	Contractor	Fork Truck, Flatbed	65 /Hour	1,280 Manhours	84,000
15	TRANSPORT TO DISPOSAL FACILITY	Southern Pacific	Railcars	2,210 /Railcar	640 Railcars	1,415,000
16	DISPOSAL	EnviroCare		32 /CF	716,800 CF	22,938,000
17	BACKFILL COVER SITE	Contractor		1,800,000	0 LS	0
18	ENGINEERED COVER SITE	Contractor		6,300,000	1 LS	6,300,000
19	FINAL SITE SURVEY	Contractor	Monitoring	651 /Man-Day	21 Man-Days	14,000
20	FINAL SITE PREPARATION	Contractor/EG&G	Drilling ng/Equip Decon	591,000	1 LS	591,000
21	SECURITY ESCORTS/TRAINING	EG&G		40	32,000 /Manhours	1,281,000
22	SUBTOTAL CONSTRUCTION					38,158,000

OU4 PHASE I IM/IRA – ALTERNATIVES SELECTION

ROUGH ORDER OF MAGNITUDE (ROM) ESTIMATE

ALTERNATIVE IV – Liner removal – No soil treatment – Engineered cover

DATE. 3 December 1993

ITEM	TASK	RESPONSIBILITY	EQUIPMENT	UNIT COST ($/UNIT)	QUANTITY	TOTAL COST
23	ENGINEERING	A/E		10 Percent		3,816,000
24	CONTRACTOR G&A			10 7 Percent		814,000
25	PROCUREMENT	EG&G		3 Percent		1,083,000
26	PROJECT & CONSTRUCTION MGMT (P&CM)	EG&G/CM		16 Percent		6,716,000
27	SUBTOTAL					50,587,000
28	ESCALATION			3 6 Percent		1,821,000
29	SUBTOTAL					52,408,000
30	CONTINGENCY			30 Percent		15,722,000
31	TOTAL ESTIMATED COST					$68,130,000